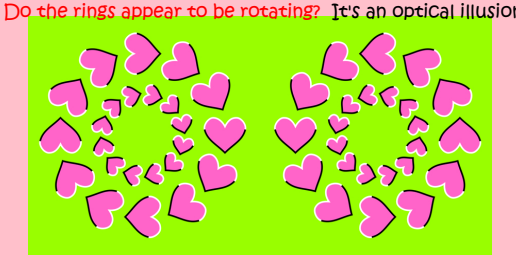
Rotations

made with sparklee.com

Check out these other files
Reflections
Translations
Dilations

Transforming Geometry into the Common Core with Transformations

Do the rings appear to be rotating? It's an optical illusion.



http://www.psy.ritsumei.ac.jp/~akitaoka/rotate23e.html

with an Interactive Notebook foldable

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http://geometrygems.wikispaces.com/MMC+Geometry+-+2015+Summer

Rotations Transformations

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Grade 8 Geometry

Understand congruence and similarity using physical models, transparencies, or geometry software.

- CCSS.Math.Content.8.G.A.1 Verify experimentally the properties of rotations, reflections, and translations:
  - CCSS.Math.Content.8.G.A.1a Lines are taken to lines, and line segments to line segments of the same length.
  - CCSS.Math.Content.8.G.A.1b Angles are taken to angles of the same measure.
  - CCSS.Math.Content.8.G.A.1c Parallel lines are taken to parallel lines.
- CCSS.Math.Content.8.G.A.2 Understand that a two-dimensional figure is congruent to another if the second can be obtained from the first by a sequence of rotations, reflections, and translations; given two congruent figures, describe a sequence that exhibits the congruence between them.

Grade 8 Geometry (cont.)

Understand congruence and similarity using physical models, transparencies, or geometry software.

- CCSS.Math.Content.8.G.A.3 Describe the effect of dilations, translations, rotations, and reflections on two-dimensional figures using coordinates.
- CCSS.Math.Content.8.G.A.4 Understand that a two-dimensional figure is similar to another if the second can be obtained from the first by a sequence of rotations, reflections, translations, and dilations; given two similar two-dimensional figures, describe a sequence that exhibits the similarity between them.

High School Geometry

Understand similarity in terms of similarity transformations

- CCSS.Math.Content.HSG-SRT.A.1 Verify experimentally the properties of dilations given by a center and a scale factor:
  - CCSS.Math.Content.HSG-SRT.A.1a A dilation takes a line not passing through the center of the dilation to a parallel line, and leaves a line passing through the center unchanged.
  - CCSS.Math.Content.HSG-SRT.A.1b The dilation of a line segment is longer or shorter in the ratio given by the scale factor.

High School Geometry (Cont.)

Understand similarity in terms of similarity transformations

- CCSS.Math.Content.HSG-SRT.A.2 Given two figures, use the definition of similarity in terms of similarity transformations to decide if they are similar; explain using similarity transformations the meaning of similarity for triangles as the equality of all corresponding pairs of angles and the proportionality of all corresponding pairs of sides.
- CCSS.Math.Content.HSG-SRT.A.3 Use the properties of similarity transformations to establish the AA criterion for two triangles to be similar.

Common Core Math Practices

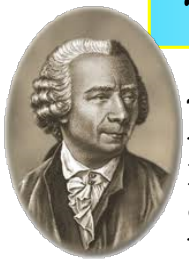
The CCSSM expects mathematically proficient geometry students to

- experiment,
- explain,
- prove,
- visualize,
- understand,
- derive, and
- translate

between representations.

Students are expected to demonstrate geometric habits of mind, and be proficient in the Standards of Mathematical Practice.

Transformations


Leonhard Euler (1707-1783)

The first use of transformations dates back to the ancient Greeks around the time of Euclid. However, not until Euler (in 1776) did anyone identify all the kinds of transformations in space that could yield congruent figures.

It is interesting that the 3-dimensional analysis of congruence was accomplished before the 2-dimensional. This is probably because the congruent objects seen daily are 3-dimensional.

rotations translations dilations reflections

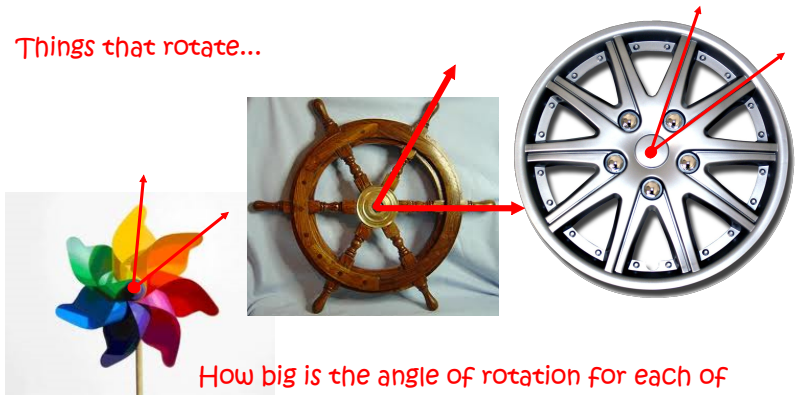
A transformation is a correspondence between sets of points such that each point in the image has exactly one preimage point.

Why study transformations?

- Studying these various transformations helps a person to become more aware of the movements of objects such as gears (which rotate) and conveyer belts (which slide).
- More complicated movements, such as those done by robots, can be taken apart into their component moves and analyzed.
- Transformations also appear in music and help to show some connections between mathematics and music.
- Things like cartoons, comics, flip books, storyboards, how-to books, and picture instructions use transformations to show motion

Definition

Things that rotate...



How big is the angle of rotation for each of these? Can you figure it out without a protractor?

What other things can you think of that show rotations?

Rotations

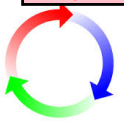
We turn frequently to see objects or to hear better or to move from one place to another. Hands on clocks turn, combination locks often involve turning, and wheels turn. The mathematical model for a turn is a rotation.

$r_n(r_m(\triangle ABC)) =$
$R_{G,degrees}(\triangle ABC) = \triangle A''B''C''$
Rotation of $\triangle ABC$ degrees° about center G

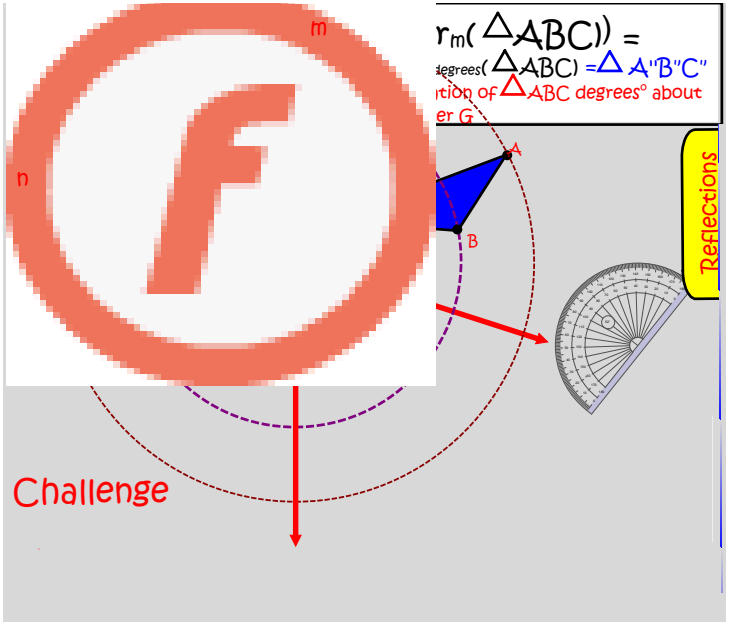
Notation

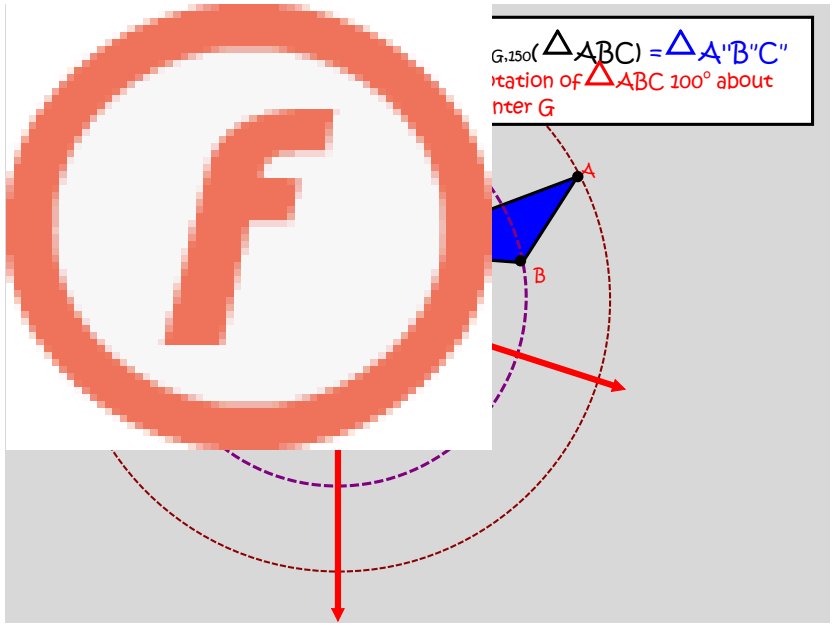
The magnitude (or amount of turn) of rotation may be any real number.

- If the magnitude is positive, the rotation is counterclockwise.



- If the magnitude is negative, the rotation is clockwise.

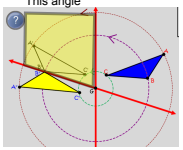




Did you figure it out?

Prove it!

Measure the angle formed by the intersecting lines (between the rotation and the pre-image) and double it to find the angle of rotation!



One possible proof

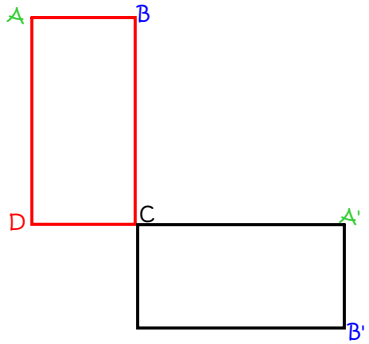
Quiz Yourself

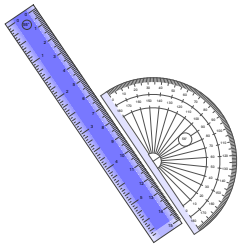
Convert R_{-400} to a rotation with a magnitude in the range of -180° to 180°.

Hints

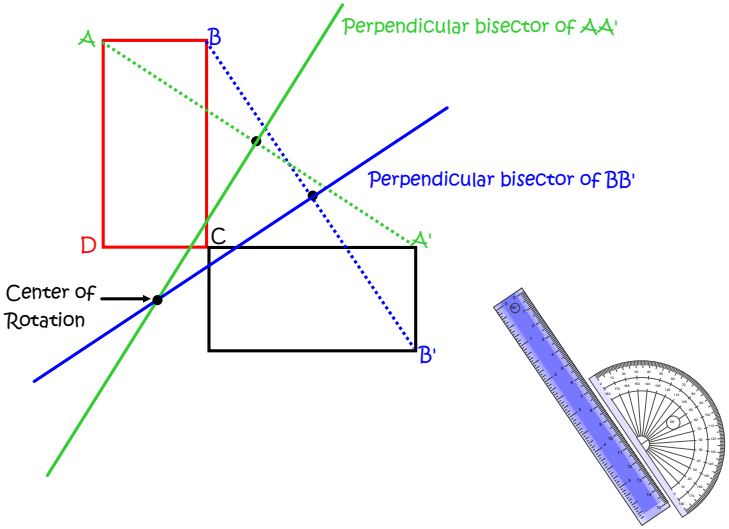
Answer

Find the center of rotation





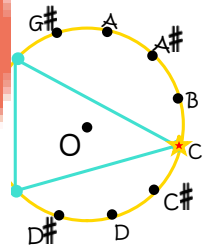
Find the center of rotation



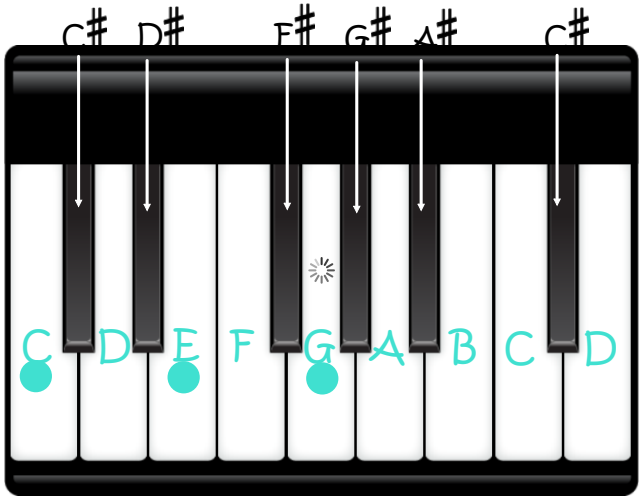
The three marked keys form a C-major chord.

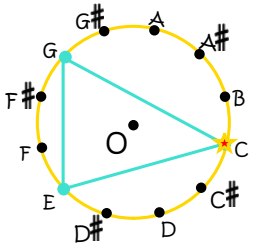
repeating patterns.

otes repeat themselves as



To find the notes of other major chords, place the possible notes on a circle and then rotate the triangle clockwise about the center O of the circle.





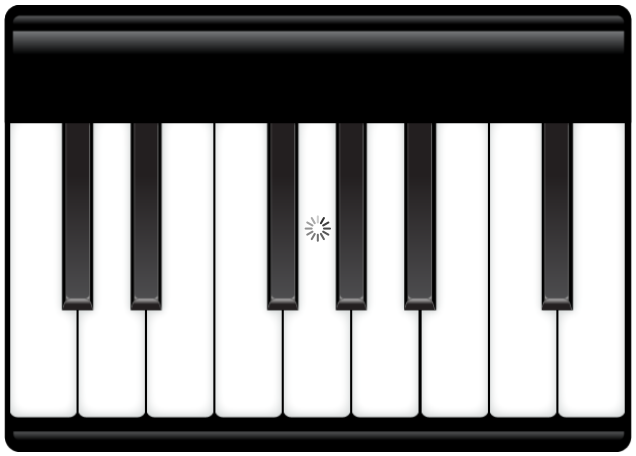
Name the notes of a D♯ (D sharp) major chord.

Answer

What is the magnitude of rotation?

Answer

The three marked keys form a C-major chord.



Answer

Rotation Challenge

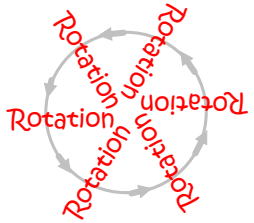
Given points A and C, draw the image of point A under a rotation of 160° about point C. Label the image A'.

A

A'

C

Find two intersecting lines that A can be reflected over to find A' and what has to be true of the line? Why?



"turn"

1

2 Definition:

click here

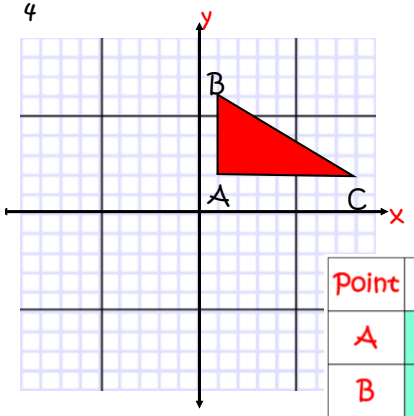
Notation:

3 Properties:

click here

click here

4



Use the "spinner" on your foldable. Trace the axes and the triangle ABC. Turn the "spinner" to find the coordinates when rotated 90°, 180°, and 270°.

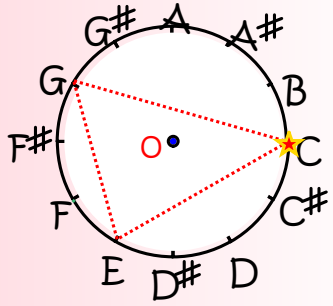
Point	(x,y)	90°	180°	270°
A				
B				
C				
	(x,y)			

5

6

C-major	C-E-G
D-major	
F-major	

C-major chord



Thank you...

Go forth and TRANSFORM the World!

Find the handouts, presentations in both SMART Board and .PDF formats at:
http://GeometryGems.wikispaces.com/iMathination

Resources/References

~~Geometry, 3rd Edition~~ - The University of Chicago School Math Project by John Benson, Ray Klein, Matthew Miller, Catherine Capuzzi-Feuerstein, Michael Fletcher, George Marino, Nancy Norem Powell, Natalie Jakucyn, and Zalman Usiskin. McGraw Hill/Wright Group, 2009.

Contact me at:
nancynpowell@gmail.com

Information

The foldable note sheets are meant to give students a place to summarize their findings and should in no instance substitute for explorations and investigations that will help students understand transformations/translations. Take time to do the activities in this file and add other activities that will enrich students' understanding of transformations/reflections.

A set of foldable student notes and samples of teacher answers are included.

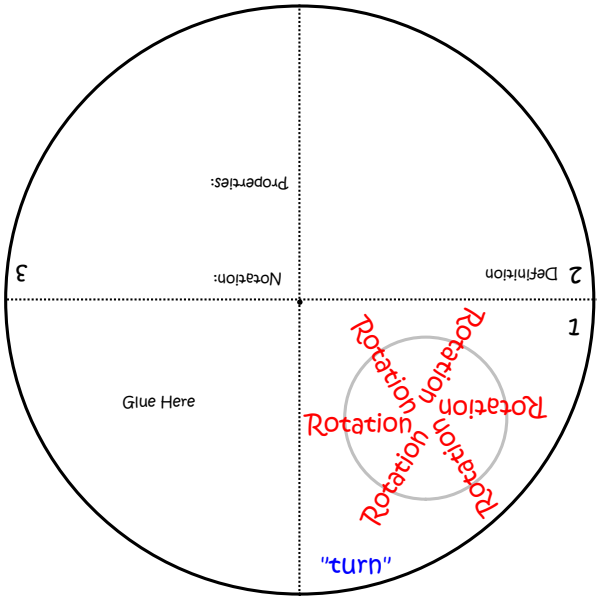
1. There are notes for rotations in this file (reflections, translations, and dilations are available in their files). Each set is two pages. If you are downloading the SMART Notebook file, you can easily edit them.

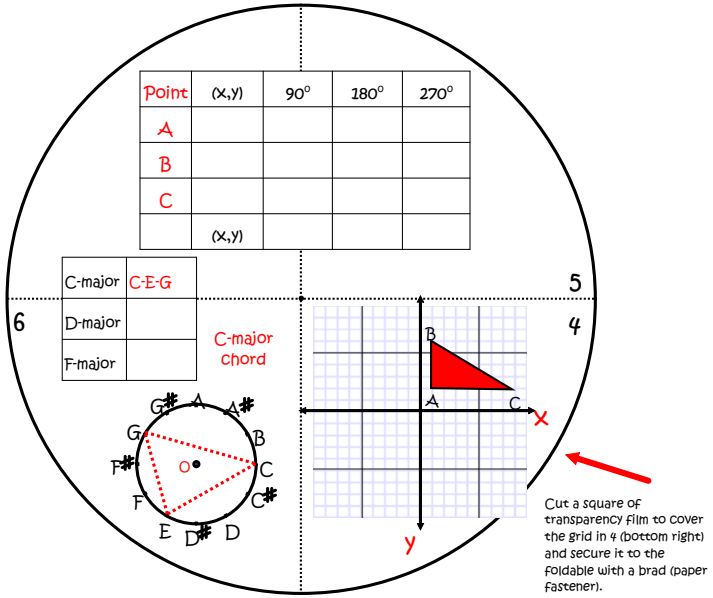
2. These notes are intended to be printed double sided and printed in color. If you print them, print them landscaped, duplex (double-sided) and make sure they flip on the short edge so the front lines up with the back. If you choose not to print them in color, students can easily add their own color to the notes.

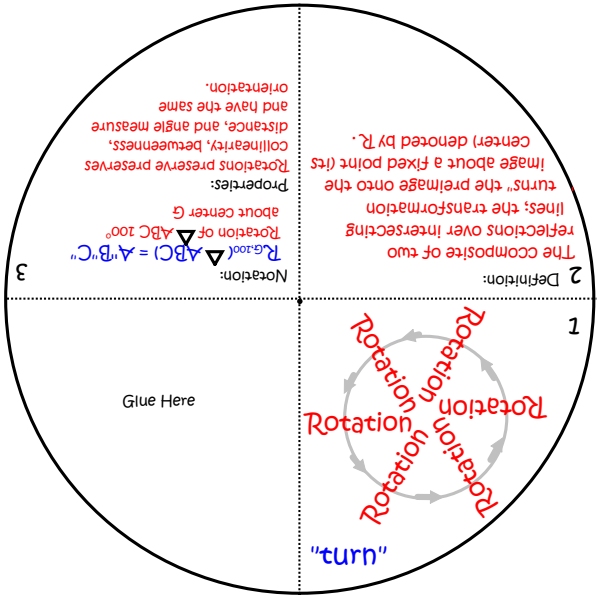
3. The notes should be cut out and folded on the dotted lines. Pictures are on
http://GeometryGems.wikispaces.com/iMathination/
to show you what these notes look like when they are folded.

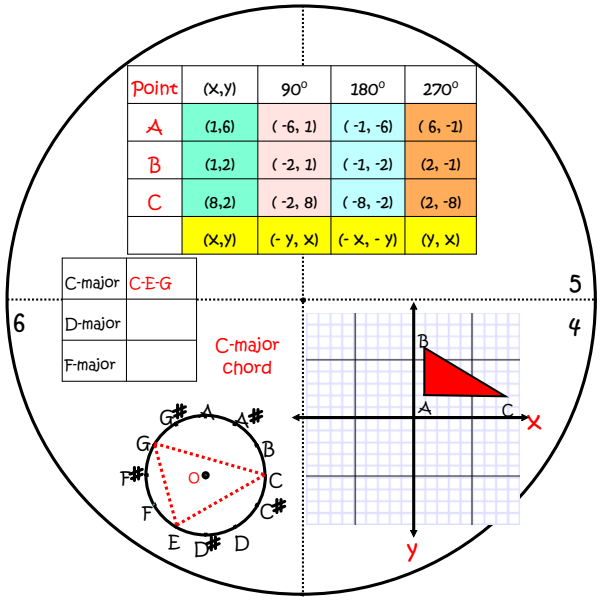
Foldables to put into an interactive notebook

To print these, make sure to read the directions




Point (x,y) 90° 180° 270°
A
B
C
(x,y)
C-major C-E-G
D-major
F-major
C-major chord
6
5
4
x
y
Cut a square of transparency film to cover the grid in 4 (bottom right) and secure it to the foldable with a brad (paper fastener).


3
Notation:
$R_{G,100}(\triangle ABC) = \triangle A''B''C''$
Rotation of $\triangle ABC$ 100° about center G
Properties:
Rotations preserve preserves collinearity, betweenness, distance, and angle measure and have the same orientation.
2 Definition:
The composite of two reflections over intersecting lines; the transformation turns" the preimage onto the image about a fixed point (its center) denoted by R.
1
Glue Here
Rotation
"turn"


Point (x,y) 90° 180° 270°
A (1,6) (-6, 1) (-1, -6) (6, -1)
B (1,2) (-2, 1) (-1, -2) (2, -1)
C (8,2) (-2, 8) (-8, -2) (2, -8)
(x,y) (- y, x) (- x, - y) (y, x)
C-major C-E-G
D-major
F-major
C-major chord
6
5
4
x
y